

Delayed Diagnosis of a Flexion-Distraktion (Seat Belt) Injury in a Patient With Multiple Abdominal Injuries: A Case Report

Michael Burdi, MD, Christopher M. Bono, MD, Christopher P. Kauffman, MD, David Hoyt, MD, and Steven R. Garfin, MD

Each year in the United States, more than 160,000 vertebral fractures occur, and more than 10,000 of these lead to spinal cord injury.¹ Roughly 50% of noncervical spinal cord injuries occur at the thoracolumbar junction.² Vertebral injuries can be masked in polytrauma patients secondary to overwhelming symptoms from concomitant injuries or in hemodynamically unstable patients who require emergent or urgent procedures before spinal assessment can be performed.³

In this report, we describe the clinical presentation, workup, and surgical management of a patient who was in a high-speed motor vehicle accident and received a delayed diagnosis of unstable thoracolumbar dislocation. Concomitant intra-abdominal injuries were the likely reason for initial masking of the spine lesion. Although these types of injuries are not rare, and missed injuries have been described in other reports, this case is unique in that the patient lacked signs or symptoms of spinal column injury at presentation. We hope to alert trauma practitioners to maintain a high index of suspicion for such injuries to avoid disastrous consequences.

CASE REPORT

A previously healthy 17-year-old woman was a rear-seat passenger wearing a lap belt when she was involved in a side-impact motor vehicle accident. When she presented to the trauma bay, her initial complaints were of severe abdominal pain. She had no specific complaints of back

pain at that time. Initial examination revealed a rigid abdomen but no significant back tenderness. Trauma room x-rays suggested a hemothorax, a ruptured diaphragm, and a right 12th rib fracture near the costovertebral junction. Subsequently, she underwent emergent abdominal exploration.

The surgeon found a ruptured diaphragm and tears in the duodenum near the insertion of the ligament of Treitz and the jejunum. The diaphragmatic rupture was repaired, and splenectomy, partial bowel resections, duodeno-jejunosotomy, and Hartmann resection with a colostomy were performed. Tolerating these procedures well, the patient was transferred to the surgical intensive care unit for a 3-day recovery. As she remained hemodynamically stable and alert, she was transferred to the surgical floor. On postoperative day 5, she began ambulating with physical therapy, and her abdominal complaints were resolved, but then she began complaining of mid- to low-back discomfort. X-rays obtained of the cervical, thoracic, and lumbar spine were read as negative by the radiologist, except for minor endplate irregularities at the thoracolumbar junction, which were thought not to be acute. The patient demonstrated no sensory or motor deficits. With continued ambulation, complaints of worsening back pain arose. An orthopedic spine consultation was requested almost 2 weeks after initial injury.

On thorough spinal examination, the consultant team noted a slightly prominent spinous process near the thoracolumbar junction. The patient had minimal tenderness to palpation about the spine, with only mild soreness near the right paraspinal area near the rib fracture. Sensory, motor, reflex, and rectal examinations were normal. The spine consultants' review of thoracic and lumbar spine x-rays revealed what appeared to be bilateral perched facets and an increased interspinous process distance between T12 and L1 (Figures 1A, 1B). After the patient was placed on immediate log-roll precautions, a computed tomography (CT) scan of T11 to L2 revealed "naked facets" bilaterally at the superior articular process of L1 and the inferior articular process of T12. Additional findings included mild disruption of the antero-inferior endplate of T12 anteriorly without significant height loss. There was no apparent translation of T12 on L1.

The patient was taken to surgery the next day for open reduction through a posterior approach followed by instrumented fusion of T12 to L1. Intraoperative examina-

Dr. Burdi is Resident, Division of Spine Surgery, Department of Orthopaedic Surgery, University of California San Diego Medical Center, San Diego, California.

Dr. Bono is Chief of Spine Division, Department of Orthopaedic Surgery, Brigham and Women's Hospital, Boston, Massachusetts.

Dr. Kauffman is Attending Surgeon, University Hospital, Lebanon, Tennessee.

Dr. Hoyt is Chief, Division of Trauma, Department of Surgery, and Dr. Garfin is Chairman, Department of Orthopaedic Surgery, University of California San Diego Medical Center, San Diego, California.

Requests for reprints: Christopher M. Bono, MD, Brigham and Women's Hospital, 75 Francis St, Boston, MA 02115 (tel, 617-732-7238; fax, 617-732-6397; e-mail, bonocm@prodigy.net).

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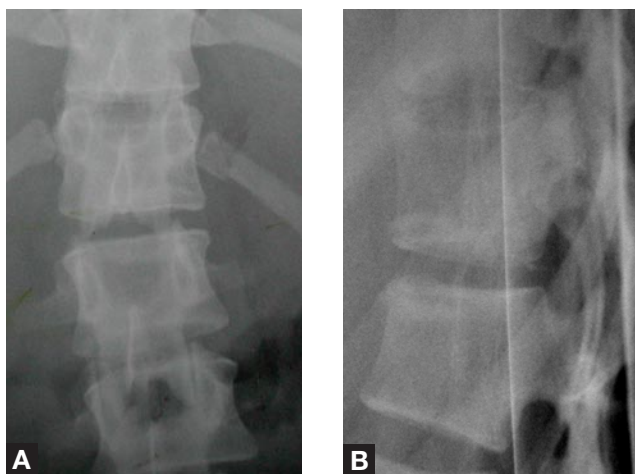


Figure 1. Anteroposterior (A) and lateral (B) preoperative x-rays of thoracolumbar junction. Note minor endplate changes and slight segmental deformity. The posterior interspinous process distance is widened, and the facet complex appears incompetent.

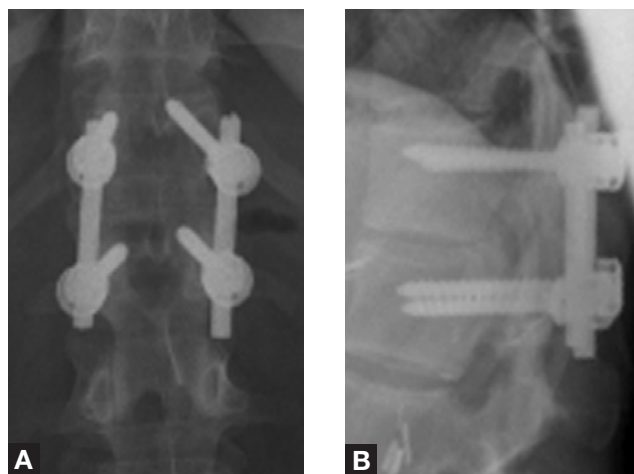


Figure 2. Final follow-up anteroposterior (A) and lateral (B) postoperative x-rays of thoracolumbar junction after reduction and T12–L1 instrumented fusion with iliac crest bone graft. Solid fusion is noted. Instrumentation consists of posteriorly inserted pedicle screws and rods placed in compression to maintain anatomical reduction of the facet complex.

tion confirmed the presence of bilaterally dislocated facet joints. Instrumentation consisted of posteriorly inserted pedicle screws and rods placed in compression to maintain anatomic reduction of the facet complex (Figures 2A, 2B). Tolerating the procedure well, the patient was placed in a custom-molded thoracolumbosacral orthosis with a cutout for the colostomy; the orthosis allowed her to be out of bed and ambulating on postoperative day 2. Remaining neurologically intact, she was discharged from the hospital 21 days after initial admission. The colostomy was reversed at 4 months, and at 10-month follow-up evaluation she denied complaints of back pain. X-rays showed a solid fusion from T12 to L1 with no failure of the implants.

“...thoracolumbar injuries are often missed in multitrauma patients....”

DISCUSSION

Injuries at the thoracolumbar junction are not infrequent in trauma cases. Bilateral facet dislocations constitute approximately 11% of thoracolumbar spine injuries requiring operative stabilization and are commonly referred to as *Chance fractures*, *seat belt injuries*, and *flexion-distraction fractures*.⁴ Flexion-distraction forces are the most common mechanism of injury. Roughly two thirds of these patients present with complete neurologic injuries, with most others sustaining incomplete spinal cord or cauda equina injuries. Absence of neurologic injury is rare. A University of Michigan Transportation Research Institute review of car crash injuries and National Highway Traffic Safety Administration files implicated lap belts in many Chance injuries.⁵ Interestingly, thoracolumbar spine injuries were found to be fairly common, even in low-speed crashes.

Diagnosis

A review of the literature indicates that thoracolumbar injuries are often missed in multitrauma patients, especially those with critical injuries requiring immediate attention.³ The association of flexion-distraction spine injuries with intra-abdominal pathology was first described by Garrett and Braunstein,⁶ who coined the term *seat belt syndrome*. These patients often present with the “seat belt sign” involving abrasions and ecchymosis in the lower abdomen, where a lap belt rests. With the seat belt acting as a fulcrum, the spine fails about an axis of rotation anterior to the anterior longitudinal ligament—producing minimal anterior column compression or height loss. Up to 80% of patients with flexion-distraction spine injuries from seat belts have major concomitant intra-abdominal injuries. Hollow, viscous structures are the most commonly damaged, especially with isolated lap belt use in rear-seat passengers.⁷ Because of the potential consequences of delaying or missing a thoracolumbar injury, the 1993 Advanced Trauma Life Support (ATLS) guidelines recommend a screening anteroposterior x-ray of the thoracic and lumbar spine for all polytrauma patients until completion x-rays can be obtained.⁸ In our patient’s case, a deviation from ATLS guidelines was noted, as the first x-rays of the spine were obtained on day 5. However, even on these x-rays, the extent of the injury was underappreciated as a benign, possibly old endplate fracture. Although the spine can be visualized on CT and magnetic resonance imaging (MRI) scans obtained to evaluate the abdomen and retroperitoneum, these scans should not supplant dedicated spine CT or MRI scans if the index of suspicion is sufficiently high.

Treatment

As most injuries are primarily ligamentous (poor healing potential), and concomitant intra-abdominal injuries are frequent, nonoperative management by bracing is not

ideal. In most cases, surgical treatment is preferable. Early open reduction and posterior instrumented fusion at the involved level is recommended.⁹ Purely osseous Chance fractures can be treated with hyperextension bracing for 3 to 6 months.¹⁰

Restoring spinal stability is important both for reducing the likelihood of further neurologic compromise and for helping to avoid chronic pain. Considering the integrity of the 3 columns of the spine helps the surgeon to determine type of instrumentation and approach. Flexion-distracton or Chance injuries involve disruption of all 3 spinal columns, though the integrity of the anterior longitudinal ligament is usually preserved. Without substantial vertebral body height loss, as in our patient's case, adequate stabilization can be achieved using a stand-alone compressive posterior construct to restore the tension band. With more substantial fracture, or with comminution of the vertebral body, combined anterior and posterior (circumferential) procedures may be preferable.

CONCLUSIONS

In this report, we have highlighted how diagnosis of an unstable spinal injury can be easily missed in the polytrauma patient. In some cases, a delay in diagnosis can have devastating consequences. Our patient was unusual in that she was neurologically intact, and her back symptoms were minimal. This presentation is rare. Concurrent serious injuries, such as diaphragmatic rupture and bowel perforations, can mask symptoms but should be red flags for the flexion-distracton mechanism that often leads to these unstable lesions. The clearest tip-off is the scenario of a lap-belted

patient with an abdominal injury. The highest degree of suspicion for spinal injuries needs to be maintained for all polytrauma patients until a more complete secondary evaluation can be performed. Until reasonable doubt is removed through a complete examination and appropriate imaging, spinal precautions should be maintained.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.
